WHAT IS CLAIMED IS:

1. A method for choosing an image from a plurality of three-dimensional models which is most similar to an input image; the method comprising the steps of:

(a) providing a database of the plurality of three-dimensional models;

(b) providing an input image;

(c) positioning each three-dimensional model relative to the input image;

(d) for each three-dimensional model, determining a rendered image that is most similar to the input image by:

(i) computing a linear subspace that describes an approximation to the set of all possible rendered images that each three-dimensional model can produce under all possible lighting conditions where each point in the linear subspace represents a possible image; and

(ii) finding the point on the linear subspace that is closest to the input image;

(e) computing a measure of similarly between the input image and each rendered image; and

(f) selecting the three-dimensional model corresponding to the rendered image whose measure of similarity is most similar to the input image.

2. The method of claim 1, wherein step (a) comprises building each three-dimensional model from a series of images taken under predetermined lighting conditions.

3. The method of claim 1, wherein step (a) comprises assigning a location to each point on the surface of each three-dimensional model and at least one corresponding identifier which identifies the fraction of light that is reflected at each point.

4. The method of claim 3, wherein the at least one corresponding identifier comprises three albedos, one for each of how much red, blue, and green light is reflected.

5. The method of claim 1, wherein step (b) comprises providing a two-dimensional input image.

6. The method of claim 1, wherein step (c) comprises aligning predetermined points on the three-dimensional model and the input image.

7. The method of claim 1, wherein step (d) is repeated for each of a red, green, and blue color component for each three-dimensional model.

8. The method of claim 3, wherein step (d)(i) comprises computing polynomials from descriptions of the direction of the surface normal at each point and from the at least one corresponding identifier.

9. The method of claim 1, wherein the linear subspace is four-dimensional.

10. The method of claim 1, wherein the linear subspace is nine-dimensional.

11. The method of claim 1, wherein step (e) comprises determining the magnitude of the difference between the input image and each rendered image.

12. The method of claim 1, wherein step (d)(ii) comprises computing the point in the linear subspace that is closest to the input image using a linear projection.

13. A method for choosing an image from a plurality of three-dimensional models which is most similar to an input image; the method comprising the steps of:

(a) providing a database of the plurality of three-dimensional models;

(b) providing an input image;

(c) positioning each three-dimensional model relative to the input image;

(d) for each three-dimensional model, determining a rendered image that is most similar to the input image by:

(i) computing a linear subspace that describes an approximation to the set of all possible rendered images that each three-dimensional model can produce under all possible lighting conditions where each point in the linear subspace represents a possible image; and

(ii) finding a rendered image in a subset of the linear subspace obtained by projecting the set of images that are generated by positive lights onto the linear subspace;

(e) computing a measure of similarly between the input image and each rendered image; and

(f) selecting the three-dimensional model corresponding to the rendered image which is most similar to the input image.

14. The method of claim 13, wherein step (a) comprises building each three-dimensional model from a series of images taken under predetermined lighting conditions.

15. The method of claim 13, wherein step (a) comprises assigning a location to each point on the surface of each three-dimensional model and at least one corresponding identifier which identifies the fraction of light that is reflected at each point.

16. The method of claim 15, wherein the at least one corresponding identifier comprises three albedos, one for each of how much red, blue, and green light is reflected.

17. The method of claim 13, wherein step (b) comprises providing a two-dimensional input image.

18. The method of claim 13, wherein step (c) comprises aligning predetermined points on the three-dimensional models and the input image.

19. The method of claim 13, wherein step (d) is repeated for each of a red, green, and blue color component for each three-dimensional model.

20. The method of claim 15, wherein step (d)(i) comprises computing polynomials from descriptions of the direction of the surface normal at each point and from the at least one corresponding identifier.

21. The method of claim 13, wherein the linear subspace is four-dimensional.

22. The method of claim 13, wherein the linear subspace is nine-dimensional.

23. The method of claim 13, wherein step (e) comprises determining the magnitude of the difference between the input image and each rendered image.

24. The method of claim 21, wherein step (d)(ii) comprises rendering an image of each three-dimensional model using non-negative lighting by solving a sixth order polynomial.

25. The method of claim 22, wherein step (d)(ii) comprises finding the rendered image that is a convex combination of images generated with light coming from a single direction, projected onto the nine-dimensional space.

26. The method of claim 25, wherein the rendered image is found using a non-negative least squares algorithm.